

Correction of 2nd MTP Instability Utilizing a Weil Osteotomy and Dorsal Approach Plantar Plate Repair – A New Technique & Early Results

Kelly A. Malinoski, DPM, Lowell Weil, Jr., DPM, Lowell Scott Weil, Sr., DPM

WEIL FOOT & ANKLE INSTITUTE, DES PLAINES, IL www.weil4feet.com

Introduction

The plantar plate is the principal sagittal plane stabilizer of the metatarsal-phalangeal joint (MTP) and any compromise to the integrity of the plate can lead to wearing and rupture of this joint. Plantar plate tears often contribute to metatarsalgia, leading to chronic instability, subluxations, and dislocations. A plantar plate rupture can be either acute, due to a hyperextension injury, or chronic in nature, secondary to chronic metatarsal overload. Primary repair of a plantar plate tear has been performed for years, although the etiology of a non-traumatic, isolated primary plantar plate injury has not been clearly understood.^{1,2,3} The traditional repair of the plate from a plantar approach is both difficult and does not address the underlying etiology of those cases caused by chronic pathology: an elongated or sub-located lesser metatarsal.

We present a new technique and early results that incorporate a *Weil Metatarsal Osteotomy and primary repair of the plantar plate through a DORSAL approach*. We have utilized this technique for over two years with promising early results. This unique surgical technique addresses and allows for correction of both the metatarsal deformity and plantar plate pathology through one, minimally invasive, surgical approach.

Surgical Technique

- A curvi-linear incision is made overlying the 2nd MTPJ exposing the metatarsal head and base of the proximal phalanx.

- A Weil metatarsal osteotomy is performed and the capital fragment is retrograded under the distal one third of the metatarsal, and is held in temporary position with a smooth .045 wire. This allows for exposure to the plantar plate and flexor tendon, when visible. The redundant dorsal bone surface is resected about 3-4 mm and smoothed to normal anatomical contour (FIG. 3).

- The plantar plate is visualized and noted to be torn (in this case) and/or attenuated (in other cases) at the insertion in the base of the proximal phalanx. The plantar plate is fully mobilized distally and freed of any residual attachments. (FIG. 4).

- Using the *Smart Stitch System**, #2 Magnum wire is used to grab and fixate the plantar plate proximally with a mattress suture (FIG. 5, 6, 7).

- Two drill holes are then made with .062 threaded k-wires in the base of the proximal phalanx; one dorsal-medial to central and the other dorsal-lateral to central (FIG. 8). Using monofilament wire through the bone tunnels, the sutures securing the plantar plate are passed from the plantar to the dorsal surface of the base of the proximal phalanx.

- The temporary pin fixating the Weil osteotomy is removed and the 2nd metatarsal head is reduced, properly aligned to create corrected positioning and fixated with a 2.4mm threaded head screw or two .062 threaded k-wires (FIG. 9, 11).

- The suture on the dorsal surface of the proximal phalanx is now tied dorsally with the digit held in plantarflexion, and the 2nd MTP is reduced and stabilized (FIG. 10, 11, 12).

*Arthrocare Opus

FIG. 1
Pre-op



FIG. 2
Pre-op



FIG. 3



FIG. 4



FIG. 5

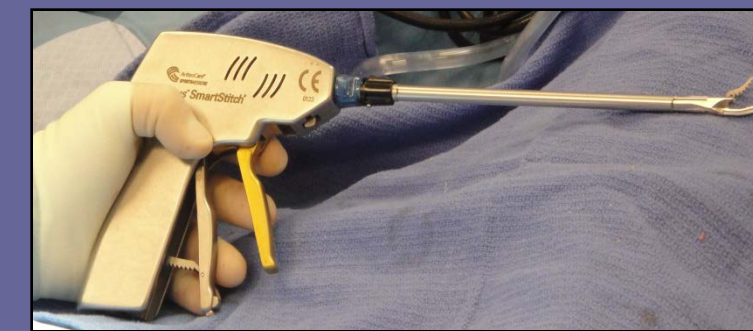


FIG. 6



FIG. 7

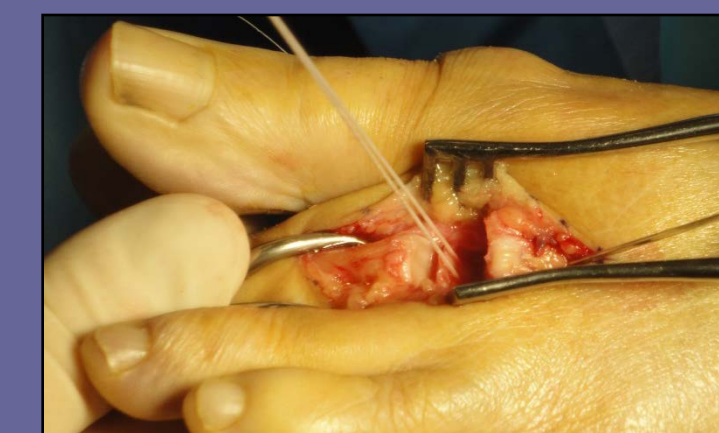


FIG. 8
Drill
Hole
positions



FIG. 9



FIG. 10

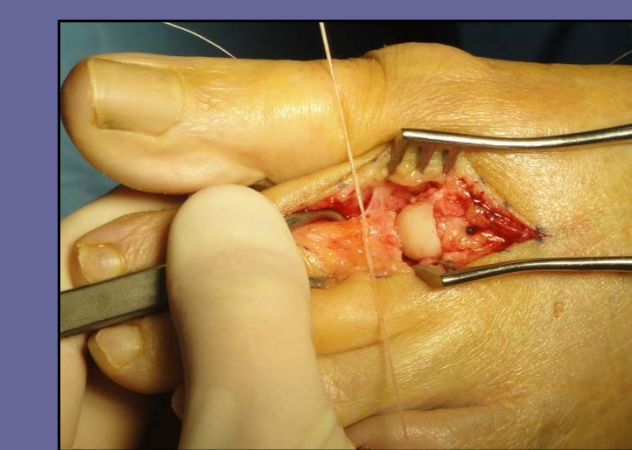


FIG. 11
Post-op



FIG. 12
Post-op



Methods

Study Design

Patients with plantar plate pathology were identified using retrospective chart review (11 to 25 months post-operative) and recruited to participate in this retrospective, post-operative follow-up study (N=13).

Data Collection

Patients were administered four subjective instruments during their follow-up clinical office visit. Instruments were completed before any clinical assessment to avoid biasing patient's responses. Several instruments include objective clinician rating, which were completed during the course of the office visit. Retrospective chart review was used to obtain pre-operative pain ratings as well as the number of post operative physical therapy sessions attended.

Instrumentation

1. The 8-item American Orthopedic Foot and Ankle Society (AOFAS) Lesser Metatarsophalangeal-Interphalangeal Scale: a patient-reported measure of pain combined with a clinician rating of function and alignment.
2. The 3-item AOFAS Hallux MPJ Scale: a patient-reported measure of pain and function.
3. The 10-item Weil Satisfaction Survey: a newly developed patient-reported measure of function, pain, patient satisfaction, level of improvement and time necessary to resume regular activities.
4. The American College of Foot and Ankle Surgery Forefoot (excluding First Ray) Scale: a patient-reported measure of pain, cosmesis, and functional capacities with clinician ratings of radiography and function.

Statistical Analysis

Descriptive statistics were used to examine the distribution for all key variables. For categorical variables (i.e., level of satisfaction, level of function, and etc.), frequency counts were calculated. For continuous variables (i.e., level of improvement, level of pain), measures of central tendency and dispersion were calculated. Change in level of pain was assessed using a paired samples t-test. Additional analyses included cross tabulation and correlations of key variables to further understand the data. SAS version 9.1 was used for all analyses.

Results

Patient Demographics

The study included 13 patients (average age 58, range 42-70 years) with right (n=6), left (n=5), or bilateral (n=2) plantar plate pathology. 12 patients (92.3%) participated in an average of 10 physical therapy sessions (range 1-20).

Patient Satisfaction

9 out of 13 patients (69.2%) were moderately to extremely satisfied with the procedure. Of the 4 patients who were not satisfied, 2 out of 4 indicated a reduction in pain between assessments, 1 patient returned to surgery for pin removal, and 1 patient may be attributing a painful varus deformity with pain from this procedure.

Function and Daily Activities

11 out of 13 patients (84.6%) reported similar or improved post-operative functioning. All patients were able to return to their routine daily activities at an average of 14.7 weeks (SD=7.4, range=4-24 weeks).

Pain

Patients reported a 71.9% (SD=36.4) improvement in pain post-operatively. There was a significant reduction in patient report pain rating (t=6.824, df=13, p<0.0001). The average change in pain rating (0-10) was a 4.9 point decline (SD=2.7, range 2-8 reduction). Pre-operatively, patients reported an average pain score (0-10) of 6.7 (SD=1.7, range=2-9). Post-operatively, patients reported an average pain score (0-10) of 1.6 (SD=1.4, range 0-4).

Scale	Subscale	Mean (SD)*
ACFAS	Pain Score (0-30)	25.7 (7.3)
	Cosmesis Score (0-5)	3.6 (1.5)
	Functional Capacities Score (0-15)	11.0 (3.9)
	Radiographic Score (0-18)	13.2 (5.1)
	Function (0-32)	28.5 (5.3)
ACFAS Total Score (0-100)		82.0 (13.7)
AOFAS	Pain Score (0-40)	34.7 (7.4)
	Function Score (0-45)	37.5 (3.9)
	Alignment Score (0-15)	13.6 (2.9)
	AOFAS Total Score (0-100)	85.7 (11.8)

Conclusions

Metatarsophalangeal joint instability/dislocation can be a very difficult problem for patients and surgeons. Until recently, repair of the plantar plate was limited to soft tissue correction without addressing the bony etiology of the deformity.

Through a dorsal approach, a Weil Osteotomy is performed and the plantar plate tear is visualized and primarily repaired, advanced, and strongly anchored into bone using a shoulder arthroscopy knotless system, addressing and correcting the true etiology of plantar plate pathology.

Despite the small sample size, this procedure has been shown to yield consistent and favorable early results across the domains of patient satisfaction, pain, function and daily activities, as well as ACFAS & AOFAS Scoring Scales

References

1. R.B. Johnston III, J. Smith and T. Daniels, The plantar plate of the lesser toes: an anatomical study in human cadavers, *Foot Ankle Int* 15 (1994), pp. 276-282.
2. Blitz, DPM, et al. Plantar Plate Repair of the Second Metatarsal Phalangeal Joint: Technique and Tips. *Journal of Foot & Ankle Surgery*. Vol. 43, Issue 4. 266-270.
3. Bouché DPM, FAFAS, Heit DPM, FAFAS Combined Plantar Plate and Hammertoe Repair with Flexor Digitorum Longus Tendon Transfer for Chronic, Severe, Saggital Plane Instability of the Lesser MPJ's: Preliminary Observations. *Journal of Foot & Ankle Surgery*. Vol. 47, Issue 2, 2008. 125-37.